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IS 302-2-21 (2011): Safety of Household and Similar Electrical Appliances, Part 2: Particular Requirements, Section 21: Stationary Storage Type Electric Water Heater [ETD 32: Electrical Appliances]

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भारतीय मानक

घरेलू और समान विद्युत साधित्रों की सुरक्षा

भाग 2 विशेष अपेक्षाएँ

अनुभाग 21 भंडार किस्म के बिजली के वाटर हीटर

(पहला पुनरीक्षण)

Indian Standard

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

PART 2 PARTICULAR REQUIREMENTS

Section 21 Stationary Storage Type Electric Water Heater

(First Revision)

ICS 91.140.65;13.120

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

September 2011 **Price Group 5**

Electrical Appliances Sectional Committee, ETD 32

FOREWORD

This Indian Standard (Part 2/Sec 21) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1992. This first revision has been undertaken primarily to align the existing standard with latest International Standard.

This standard covers the safety requirements of stationary storage type electric water heater. This standard however does not cover the performance requirements which is covered under IS 2082 : 1993 'Staionary storage type electric water heater (*third revision*)'.

It has been assumed in the formulation of this standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the International accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

If the functions of an appliance are covered by different Parts and Sections of IS 302, the relevant Part and Section is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

NOTE — Throughout this standard, when Part 2 is mentioned, it refers to the relevant Part of IS 302.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

Application of this standard, as far as is reasonable, may be considered to appliances not mentioned in a Part 2, and to appliances designed on new principles.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features, which impair the level of safety, covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

This standard is to be read in conjunction with IS 302-1 : 2008 'Safety of household and similar electrical appliance: Part 1 General requirements'. For the sake of convenience, the clauses of this standard corresponds to those of IS 302-1 : 2008, instead of reproducing full text of each clause, clauses of IS 302-1 : 2008 which is applicable (which means that relevant provisions of the clause apply) or not applicable and the sub-clauses or portion there of which are not applicable are indicated as under:

a) In case of a clause where it is applicable, the wording used is 'This clause of IS 302-1 : 2008 is applicable/ not applicable'; and
b) In case of sub-clause or part thereof 'Not applicable'.

Wherever a sub-clause of IS 302-1 : 2008 is to be replaced by a new text, it has been indicated as under:

'Replacement — followed by the new text'.

Any addition to the existing provision of a sub-clause of IS 302-1 has been indicated as under:

'Addition — followed by the text of the additional matter'.

(*Continued on third cover*)

Indian Standard

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

PART 2 PARTICULAR REQUIREMENTS

Section 21 Stationary Storage Type Electric Water Heater

(First Revision)

1 SCOPE

This clause of Part 1 is replaced by the following:

This standard deals with the safety of electric storage water heaters for household and similar purposes and intended for heating water below boiling temperature, their rated voltage being not more than 250 V for single-phase appliances and 415 V for other appliances.

Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account,

a) the use of appliances by young children or infirm persons without supervision; and
b) playing with the appliance by young children.

NOTES

101 Attention is drawn to the fact that,

a) for appliances intended to be used at high altitudes, additional requirements may be necessary; and
b) for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;

102 This standard does not apply to,

a) appliances for boiling water (IS 302-2-15);
b) instantaneous water heaters (IS 302-2-35);
c) commercial dispensing appliances and vending machines (No Indian Standard exist at present);
d) appliances intended exclusively for industrial purposes; and
e) appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 REFERENCES

This clause of Part 1 is applicable except as follows:

Addition

IS No.	*Title*
191 (Part 1 to 10) : 1980	Copper (*third revision*)
1570 (Part 5) : 1985	Schedule for wrought steels: Part 5 Stainless and heat resisting steels (*second revision*)
3972 (Part 2/ Sec 2) : 1985	Methods of test for vitreous enamelware: Part 2 Test methods, Section 2 Low and high voltage tests for detecting and locating defects (*first revision*)
13273 : 1991	Vitreous enamelled inner tanks for storage water heaters

3 TERMINOLOGY

This clause of Part 1 is applicable except as follows:

3.1.9 *Replacement*

Normal Operation — Operation of the appliance after installation in accordance with the instructions and filled with cold water.

3.101 Storage Water Heater — Stationary appliance for heating and storing water in a container and incorporating devices to control the water temperature.

3.102 Closed Water Heater — Unvented storage water heater intended to operate at the pressure of the water system, the flow of water being controlled by one or more valves in the outlet system.

NOTES

1 A closed water heater is shown in Fig. 101A.

2 The operating pressure may be the output pressure of a reducing or boosting device.

3.103 Cistern-Fed Water Heater — Storage water heater that is vented to atmosphere and intended to be supplied by water under gravity from a separate cistern, the flow of water being controlled by one or more valves in the outlet system.

NOTES

1 A cistern-fed water heater is shown in Fig. 101D.

2 The water heater may be installed so that the expanded water returns to the cistern.

3 In a cistern-fed water heater, the pressure in the container results from the column of water in the cistern.

3.104 Cistern-Type Water Heater — Storage water heater having a container supplied by water under gravity from a cistern incorporated in the appliance. The expanded water can return to the cistern, the flow of water being controlled by one or more valves in the outlet system.

NOTES

1 A cistern-type water heater is shown in Fig. 101C.

2 In a cistern-type water heater, the surface of the water is always at atmospheric pressure.

3.105 Open-Outlet Water Heater — Storage water heater in which the flow of water is only controlled by a valve in the inlet pipe and in which the expanded or displaced water flows through the outlet.

NOTES

1 An open-outlet water heater is shown in Fig. 101B.

2 In an open-outlet water heater, the static pressure at the outlet is always at atmospheric pressure.

3.106 Low-Pressure Water Heater — Storage water heater that is vented to atmosphere and intended to be connected to the water mains through a pressure reducing valve, the flow of water being controlled by one or more valves in the outlet system.

NOTE — A low-pressure water heater is shown in Fig. 101E.

3.107 Rated Pressure — Water pressure assigned to the appliance by the manufacturer.

4 GENERAL REQUIREMENT

This clause of Part 1 is applicable.

5 GENERAL CONDITIONS FOR THE TESTS

This clause of Part 1 is applicable except as follows:

5.2 Addition

NOTE **101** — Additional appliances may be required if damage occurs during the tests of **19.2** or **19.3**.

5.3 Addition

When the tests are carried out on a single appliance, the tests of **22.102**, **22.103**, **22.112** and **24.102** are carried out before the tests of **19**.

5.101 The procedure for pressure test when carried out as routine test are given in Annex A.

6 CLASSIFICATION

This clause of Part 1 is applicable except as follows:

6.1 Modification

Water heaters shall be class I, class II or class III.

6.2 Addition

Water heaters for installation outdoors shall be at least IPX4. Other water heaters shall be at least IPX1.

7 MARKING AND INSTRUCTIONS

This clause of Part 1 is applicable except as follows:

7.1 Addition

Appliances, other than cistern-type water heaters, shall be marked with the rated pressure in pascals.

Appliances shall be marked with the rated capacity in litres.

Closed water heaters shall be marked with a statement that a pressure-relief device is to be fitted in the installation, unless it is incorporated in the appliance.

Closed water heaters having a rated pressure less than 0.3 MPa and low-pressure water heaters shall be marked with a statement that a pressure reducing valve is to be fitted in the installation.

Open-outlet water heaters shall be marked, close to the outlet connection or on a tag attached to the appliance, with the substance of the following:

> **Warning** — This outlet acts as a vent and must only be connected to a fitting recommended by the manufacturer. It must not be connected to a tap.

7.12 Addition

The instructions for closed water heaters shall state the substance of the following:

a) the water may drip from the discharge pipe of the pressure-relief device and that this pipe must be left open to the atmosphere;

b) the pressure-relief device is to be operated regularly to remove lime deposits and to verify that it is not blocked; and

c) how the water heater can be drained.

7.12.1 *Addition*

The installation instructions shall state the substance of the following:

a) the type or characteristics of the pressure-relief device and how to connect it, unless it is incorporated in the appliance;

b) a discharge pipe connected to the pressure-relief device is to be installed in a continuously downward direction and in a frost-free environment;

c) the type or characteristics of a pressure reducing valve and the installation details (for appliances having a rated pressure less than 0.3 MPa).

The instructions for closed water heaters incorporating a heat exchanger shall give details on the installation of control devices and the temperature settings that are necessary to prevent operation of the thermal cut-out caused by the heat from the exchanger.

The instructions for cistern-fed water heaters and low-pressure water heaters shall contain the substance of the following:

> **Warning** — Do not connect any pressure-relief device to the vent pipe of this water heater.

7.101 The water inlet and the water outlet shall be identified. This identification shall not be on detachable parts. If colours are used, blue shall be used for the inlet and red for the outlet.

NOTE — Identification may be by means of arrows showing the direction of the water flow.

Compliance is checked by inspection.

7.102 BIS Certification Marking

The appliances may also be marked with the Standard Mark.

7.102.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the rules and regulations made thereunder. The details of conditions under which the licence for use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 PROTECTION AGAINST ACCESS TO LIVE PARTS

This clause of Part 1 is applicable.

9 STARTING OF MOTOR-OPERATED APPLIANCES

This clause of Part 1 is not applicable.

10 POWER INPUT AND CURRENT

This clause of Part 1 is applicable.

11 HEATING

This clause of Part 1 is applicable except as follows:

11.7 Replacement

The appliance is operated until steady conditions are established or until the thermostat interrupts the current for the first time after 16 h, whichever is shorter.

12 VOID

13 LEAKAGE CURRENT AND ELECTRIC STRENGTH AT OPERATING TEMPERATURE

This clause of Part 1 is applicable.

14 TRANSIENT OVERVOLTAGES

This clause of Part 1 is applicable.

15 MOISTURE RESISTANCE

This clause of Part 1 is applicable except as follows.

15.2 Addition

The test is only applicable to cistern-type water heaters.

15.3 Addition

NOTE **101** — If the appliance is too large for the humidity cabinet, the test may be carried out on those parts that contain electrical components.

16 LEAKAGE CURRENT AND ELECTRIC STRENGTH

This clause of Part 1 is applicable.

17 OVERLOAD PROTECTION OF TRANSFORMERS AND ASSOCIATED CIRCUITS

This clause of Part 1 is applicable.

18 ENDURANCE

This clause of Part 1 is not applicable.

19 ABNORMAL OPERATION

This clause of Part 1 is applicable except as follows:

19.1 Modification

Instead of the tests specified for appliances incorporating heating elements, the following applies.

For closed water heaters, low-pressure water heaters and open-outlet water heaters, compliance is checked by the tests of **19.2**, **19.3** and **19.4** if applicable. However, **19.101** applies instead for appliances not liable to be emptied in normal use and having all four of the following features:

a) an outer enclosure of metal;

NOTE **101** — Non-metallic covers may be used for the supply terminals and controls.

b) non-combustible thermal insulation;

NOTE **102** — Insulation withstanding the needle flame test of Annex E is considered to be non-combustible.

c) a capacity exceeding 30 l; and

d) a rated power input not exceeding 6 kW.

NOTE **103** — Appliances are not considered liable to be emptied in normal use if emptying through the inlet is prevented by a check valve, a pipe interrupter or an air gap. These devices may be fitted in the inlet pipe in accordance with the instructions. Emptying through openings provided for servicing purposes only is not considered to be normal use.

NOTE **104** — Cistern-fed water heaters and cistern-type water heaters are not subjected to the tests.

19.2 Addition

The appliance is operated empty, any thermal control that operates during the test of **11** being short-circuited.

NOTE **101** — If the appliance is provided with more than one thermal control, these are short-circuited in turn.

19.3 Addition

NOTE **101** — If the water heater has been damaged during the previous test, a new appliance is used.

19.4 Replacement

For open-outlet water heaters, the test of **19.2** is repeated but with the container filled with water to a level at least 10 mm above the highest point of the heating element. The appliance is operated at 1.15 times rated power input under normal operation.

NOTE **101** — If the water heater has been damaged during previous tests, a new appliance is used.

19.13 Addition

There shall be no leakage from the container during the tests.

19.101 The appliance is tested for 24 h under the conditions specified in **11** but with the container empty.

20 STABILITY AND MECHANICAL HAZARDS

This clause of Part 1 is applicable.

21 MECHANICAL STRENGTH

This clause of Part 1 is applicable.

22 CONSTRUCTION

This clause of Part 1 is applicable except as follows:

22.6 Addition

The enclosure shall have a drain hole positioned so that the water can drain without impairing electrical insulation, unless condensed water cannot accumulate within the enclosure in normal use. The hole shall be at least 5 mm in diameter or 20 mm^2 in area with a width of at least 3 mm.

Compliance is checked by inspection and measurement.

22.20 Addition

Thermal insulation shall not be used for basic insulation of internal wiring.

22.101 The rated pressure of closed water heaters intended for direct connection to the water main shall be at least 0.3 MPa.

The rated pressure of closed water heaters and low-pressure water heaters, intended to be supplied by a pressure reducing valve that is not incorporated in the appliance, shall be at least 0.1 MPa.

The rated pressure of cistern-fed water heaters shall not exceed 0.2 MPa.

NOTE — The rated pressure of open-outlet water heaters is 0 Pa.

Compliance is checked by inspection.

22.102 Appliances shall withstand the water pressure occurring in normal use.

Compliance is checked by subjecting the appliance to a water pressure of

a) twice the rated pressure, for closed water heaters. If the water heater is supplied through a pressure reducing valve, the container is subjected to twice the working pressure instead;

NOTES

1 The pressure reducing valve may be incorporated in the water-inlet pipe.

2 The working pressure is the maximum pressure in the container measured during the test of **11**.

b) 1.5 times rated pressure, for cistern-fed water heaters and low-pressure water heaters;

c) 0.15 MPa, for open-outlet water heaters; and

d) 0.03 MPa, for cistern-type water heaters.

Pressure-relief devices are rendered inoperative. The pressure is raised at a rate of 0.13 MPa/s to the specified value and is maintained at that value for 5 min.

Water shall not leak from the appliance and there shall be no permanent deformation to such an extent that compliance with this standard is impaired.

NOTES

3 Heat exchangers incorporated in an appliance are subjected to a pressure test based on their working pressure.

4 Damage to a protective coating on the inside of containers is not considered to be a hazard.

22.103 Pressure-relief devices of closed water heaters shall prevent the pressure in the container from exceeding the rated pressure by more than 0.1 MPa.

Compliance is checked by subjecting the container to a slowly increasing water pressure.

NOTE — The pressure-relief device may be fitted during installation.

22.104 The outlet of open-outlet water heaters shall be constructed so that the water flow is not limited to such an extent that the container is subjected to a significant pressure.

NOTE — This requirement is considered to be met if the cross-sectional area of the water outlet is not less than that of the inlet.

The vent pipe of low pressure water heaters shall have an internal diameter of at least 20 mm.

Compliance is checked by inspection and measurement.

22.105 Cistern-type water heaters shall be constructed so that the container is always at atmospheric pressure by means of a vent having an area of at least 30 mm^2 and a minimum dimension of at least 3 mm.

Compliance is checked by inspection and by measurement.

NOTE — Cistern-fed water heaters shall not be provided with the pressure relief valve.

22.106 Water heaters shall incorporate a thermal cut-out providing phase disconnection and which operates independently from the thermostat. However, for appliances intended to be connected to fixed wiring, the neutral conductor need not be disconnected.

Compliance is checked by inspection.

22.107 Heating elements and thermal control sensors in contact with the outer surface of the container shall be held in position securely.

Compliance is checked by inspection.

22.108 Appliances for wall mounting shall have reliable provision for fixing to a wall, independent of the connection to the water mains.

Compliance is checked by inspection.

22.109 Appliances having a capacity of more than 15 litre that cannot be emptied through a drain fitted in the water pipes shall incorporate means for draining that requires a tool for its operation.

Compliance is checked by inspection and by manual test.

NOTES

1 Residual water in the container below the end of the inlet pipe is disregarded.

2 The means for draining may be combined with a pressure-relief valve.

22.110 Open-outlet water heaters having plastic containers shall be constructed to ensure that the appliance is only likely to be installed in the intended orientation.

NOTE — Appliances marked with the mounting position adjacent to the water connections are considered to meet this requirement.

Compliance is checked by inspection.

The material of the inner container in water heaters other than open outlet water heaters and feed cistern in cistern type shall be of copper of purity not less than 99.8 percent as per IS 191. In addition the inner container can be made of stainless steel. Stainless steel of Grades 304, 304L, 316, 316L of IS 1570 (Part 5) is recommended for this purpose. The apparatus plates and all bosses for screwed connection shall be, made of gunmetal, brass of brazing quality or stainless steel. All pipes shall be of copper, brass or stainless steel.

The vitreous enamelled inner tank conforming to IS 13273 may also be used. However, the cathodic protection shall be provided for enamel inner container if complete coverage of enamel is not ensured within the limits of relevant Indian Standard. In case, cathodic protection is not provided in that case, inner container shall be subjected to high voltage test as laid down in IS 3872 (Part 2/Sec 2).

22.111 Closed water heaters incorporating a heat exchanger shall be constructed so that during normal use the thermal cut-out does not operate due to heat from the exchanger.

Thermostatic valves, by-pass valves and similar controlling devices used for this purpose shall be supplied with the appliance.

Compliance is checked by inspection.

22.112 Closed water heaters shall be constructed so that repeated drawing off does not cause the water to boil.

Compliance is checked by the following test.

The appliance is operated as specified in **11**.

When the thermostat has operated for the first time, water is drawn off at a rate of approximately 2 litre/min or 10 percent of the capacity of the appliance per minute, whichever is less, until the thermostat switches on again.

When the thermostat next operates, water is drawn off again at the same rate until the thermostat switches on, this sequence being repeated until steady conditions are established.

The temperature of the water, measured by means of a thermocouple at the outlet, shall not exceed 98°C.

22.113 Water heaters shall be resistant to vacuum impulses which may occur in normal use.

Compliance is checked by subjecting containers to a vacuum of 66 kPa (0.66 bar) for one minute. After the test, the container shall show no deformation which might result in hazard. Anti vacuum valves, if any, are not rendered inoperative.

NOTE — The test may be made on a separate container.

22.114 Water heaters shall be resistant to vacuum impulses which may occur in normal use. Compliance is checked by subjecting containers to a vacuum of 66 kPa (0.66 bar) for 1 minute. After the test, the container shall show no deformation which might result in hazard. Anti vacuum valves, if any, are not rendered inoperative. The test may be made on a separate container.

23 INTERNAL WIRING

This clause of Part 1 is applicable.

24 COMPONENTS

This clause of Part 1 is applicable except as follows:

24.1.4 *Addition*

Thermal cut-outs incorporated in water heaters shall comply with the requirements for type 2B controls in **13**, **15**, **16**, **17** and **20** of IS/IEC 60730-1, unless they are tested with the appliance.

24.101 Thermal cut-outs shall be non-self-resetting. They shall have a trip-free switching mechanism or be located so that they can only be reset after removal of a non-detachable cover.

Compliance is checked by inspection.

24.102 The operating temperature of the thermal cut-out of a water heater shall ensure that the water temperature cannot exceed 99°C or that the thermal cut-out operates before its temperature exceeds 130°C.

Compliance is checked by the test of **24.102.1** for water temperatures not exceeding 99°C or by the test of **24.102.2** for thermal cut-outs having an operating temperature up to 130°C.

24.102.1 The appliance is operated under the conditions specified in **11** until the thermostat operates for the first time. A quantity of water equal to 25 percent of the capacity of the container is then drawn off so that it is replaced by cold water.

Immediately after the thermostat operates for the second time, it is short-circuited. The test is continued until the thermal cut-out operates. The outlet valve is then opened and the temperature of the water measured at the outlet.

The temperature shall not exceed 99°C.

24.102.2 The operating temperature of the thermal cut-out is measured by means of a thermocouple positioned on its sensing element or as close as possible to it.

The water temperature for appliances having vertically oriented metallic water containers is measured by a thermocouple attached to the outer surface of the upper dome. If the water container is horizontally oriented, two thermocouples are attached to the outer surface. The position of the thermocouple is shown in Fig. 102A.

The water temperature for appliances having non-metallic water containers is measured by a thermocouple positioned 50 mm below the upper inner surface of the container, as shown in one of the diagrams of Fig. 102B. This method may also be used to measure the water temperature of appliances having vertically oriented metallic water containers.

The appliance is operated at 1.15 times rated power input under normal operation with the outlet valve closed and thermostats short-circuited. The test is continued until the thermal cut-out operates.

The thermal cut-out shall operate before its temperature exceeds 110°C. The water temperature shall not exceed 20 K of the maximum permitted operating temperature of the thermal cut-out.

25 SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CORDS

This clause of Part 1 is applicable except as follows:

25.1 Modification

Appliances shall not incorporate an appliance inlet.

26 TERMINALS FOR EXTERNAL CONDUCTORS

This clause of Part 1 is applicable.

27 PROVISION FOR EARTHING

This clause of Part 1 is applicable except as follows:

27.1 Addition

For class I water heaters, the sheath of the heating element shall be permanently and reliably connected to the earthing terminal unless,

a) the container is provided with inlet and outlet pipes of metal that are permanently and reliably connected to the earthing terminal, and
b) other accessible metal parts of the container in contact with the water are permanently and reliably connected to the earthing terminal.

28 SCREWS AND CONNECTIONS

This clause of Part 1 is applicable.

29 CLEARANCES, CREEPAGE DISTANCES AND SOLID INSULATION

This clause of Part 1 is applicable.

30 RESISTANCE TO HEAT AND FIRE

This clause of Part 1 is applicable except as follows:

30.1 Addition

The temperature rises occurring during the tests of **19.2**, **19.3** and **19.101** are not taken into account.

30.2.2 Not applicable.

31 RESISTANCE TO RUSTING

This clause of Part 1 is applicable.

32 RADIATION, TOXICITY AND SIMILAR HAZARDS

This clause of Part 1 is applicable.

101 TESTS

101.1 Type Tests

The tests specified in Table 101 shall constitute the type tests and shall be carried out on a sample selected preferably at random from regular production lot (*see* **5.3**). Before commencement of the tests, the water heater shall be visually examined and inspected of components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections, earthing and the effectiveness screws and connection. The external surface finish shall be even and free from finishing defects.

101.1.1 *Criteria of Acceptance*

Sample shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, the testing authority at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test (s) in which failure (s) had occurred. No failure should be permitted in the repeat test (s).

Table 101 Schedule of Type Tests
(*Clause* 101.1)

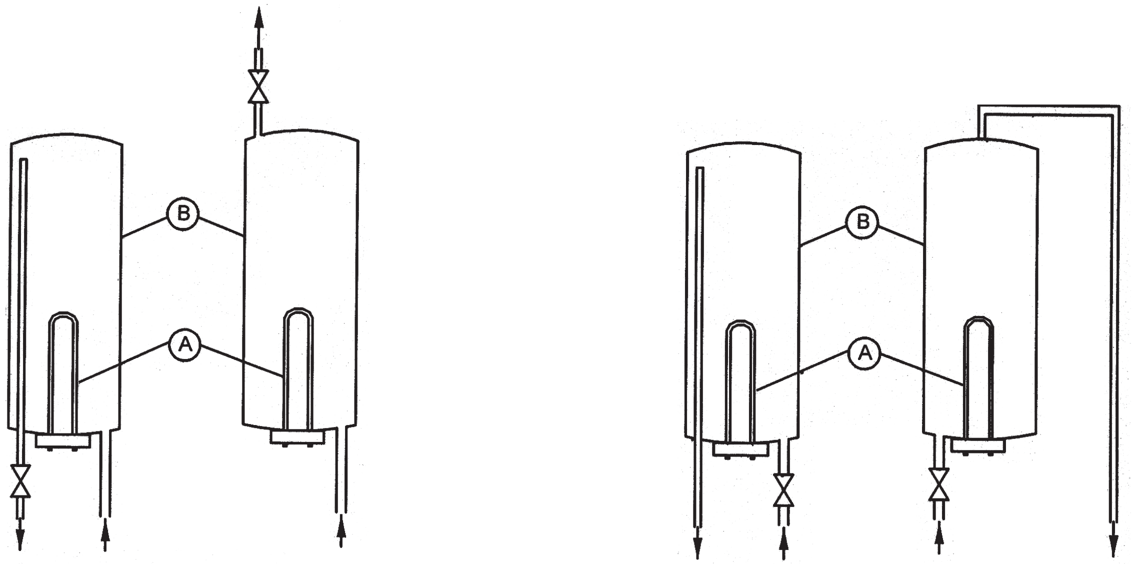
Sl No. (1)	Tests (2)	Ref to Clause (3)
i)	Protection against access to live parts	**8**
ii)	Power input and current	**10**
iii)	Heating	**11**
iv)	Leakage current and electric strength at operating temperature	**13**
v)	Transient overvoltages	**14**
vi)	Moisture resistance	**15**
vii)	Leakage current and electric strength	**16**
viii)	Overload protection of transformers and associated circuits	**17**
ix)	Abnormal operation	**19**
x)	Stability and mechanical hazards	**20**
xi)	Mechanical Strength	**21**
xii)	Construction	**22**
xiii)	Internal wiring	**23**
xiv)	Components	**24**
xv)	Supply connection and external flexible cords	**25**
xvi)	Terminals for external conductors	**26**
xvii)	Provision for earthing	**27**
xviii)	Screw and connections	**28**
xix)	Clearances, creepage distances and solid insulation	**29**
xx)	Resistance to heat and fire	**30**
xxi)	Resistance to rusting	**31**
xxii)	Radiation, toxicity and similar hazards	**32**

101.2 Acceptance Tests

The following shall constitute the acceptance tests:

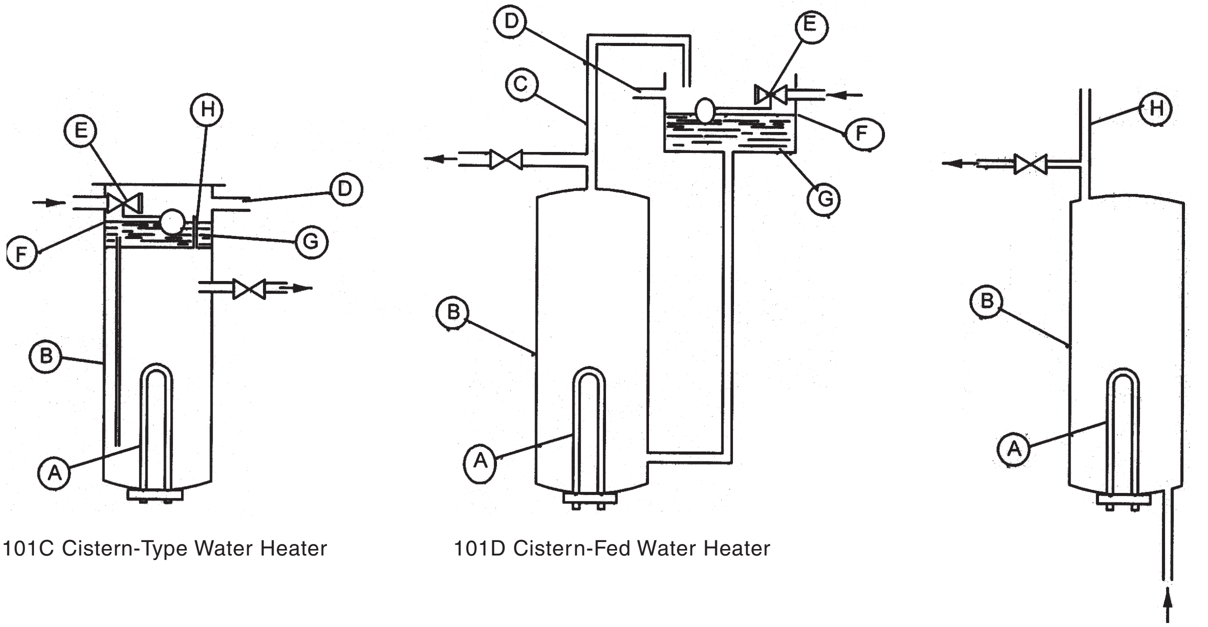
Sl No. (1)	*Test* (2)	*Ref to Clause* (3)
i)	Protection against access to live parts	**8**
ii)	Power input and current	**10**
iii)	Heating	**11**
iv)	Leakage current and electric strength at operating temperature	**13**
v)	Moisture resistance	**15**
vi)	Leakage current and electric strength	**16**
vii)	Provision for earthing	**27**

NOTE — For the purpose of acceptance tests, the humidity treatment shall be done for 24 h while conducting the test for moisture resistance (**15**).



101A Closed Water Heaters

101B Open-Outlet Water Heaters



101C Cistern-Type Water Heater

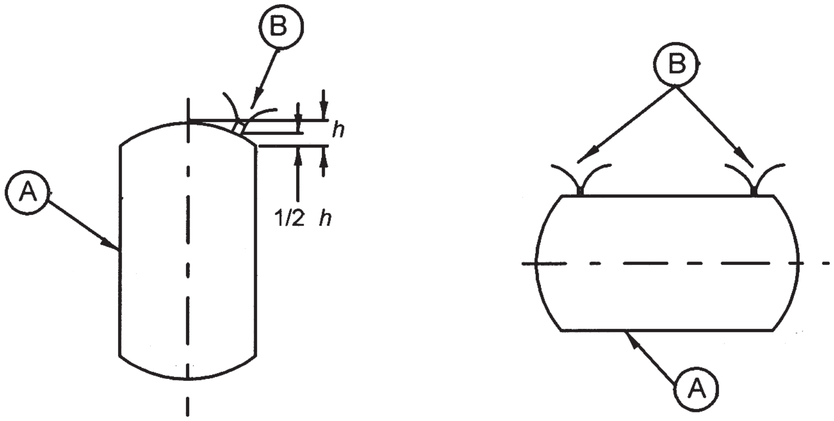
101D Cistern-Fed Water Heater

101E Low-Pressure Water Heater

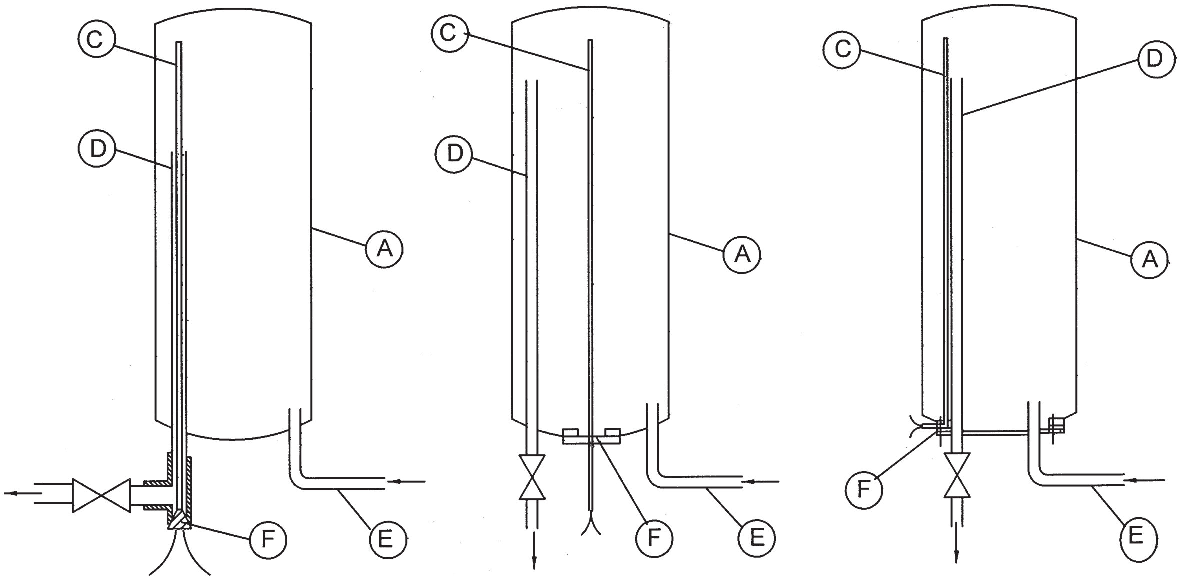
Key

A — Heating element
B — Container
C — Expansion pipe
D — Overflow pipe
E — Ball valve
F — Water level
G — Cistern
H — Vent pipe

FIG. 101 EXAMPLES OF TYPES OF STORAGE WATER HEATERS



102A Position of Thermocouples for Metallic Water Containers



The thermocouple in a tube is outlet pipe through a sealed entry

The thermocouple in a tube is inserted through a sealed entry

Insulated thermocouple wires are inserted through a sealed entry and attached to the outlet pipe

102B Position of Thermocouples for Vertically Oriented Water Containers

Key

A — Container
B — External thermocouple
C — Internal thermocouple
D — Outlet pipe
E — Inlet pipe
F — Sealed entry

Fig. 102 Examples of Positions of the Thermocouples

ANNEXES

The annexes of Part 1 are applicable except as follows:

ANNEX A

(*Clause* 5.101)

ROUTINE TESTS

This Annex of Part 1 is applicable except as follows:

A-101 PRESSURE TEST

The water container is subjected to a pressure test using a fluid.

When a liquid is used, the pressure is,

- a) for closed water heaters, 0.7 MPa for those having a rated pressure not greater than 0.6 MPa, and 1.1 times rated pressure for others;
- b) for cistern-fed water heaters and low-pressure water heaters, 1.1 times rated pressure;
- c) for open-outlet water heaters, 0.05 MPa; and
- d) for cistern-type water heaters, 0.03 MPa.

When gas is used, these pressures may be reduced but are to be sufficient to reveal leakage.

NOTE — Care should be taken when testing closed water heaters with gas.

Leakage of the fluid is not to occur during the test.

(*Continued from second cover*)

Clauses/Tables which are additional to those of IS 302-1: 2008 are numbered starting from **101** and additional sub-clauses are numbered with the main clause number followed by **101**, **102**, etc, for example, **7.101**.

Apart from the changes brought about due to the revision of IS 302-1, the following major changes have taken place during this revision of IS 302-2-21:

Clause on ratings, few terminologies, clause on operation under overload conditions, test of protection against electric shock as a routine test have been deleted. Requirement of IP has been included. Requirements for marking, abnormal operation test, water pressure for test of cistern fed water heaters, aperture size of vented water heaters and operating temperature for thermal cut out have been modified.

Should however, any deviation exist between IS 302-1 : 2008 and this standard, the provision of the latter shall apply.

This standard is based on IS 60335-2-21 : 2004, Edition 5.1 'Safety of household and similar electrical appliances: Particular requirements for storage water heaters' issued by the International Electrotechnical Commission except for the following modification:

a) The leakage current value is more stringent as compared to IEC Publication; and
b) Ambient test conditions are based on national conditions.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments Issued Since Publication

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